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Worldwide Report

NUCLEAR DEVELOPMENT AND PROLIFERATION

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CONTENTS

BRAZIL, PRC SIGN MEMORANDUM ON NUCLEAR MATTERS

PY310335 Sao Paulo FOLHA DE SAO PAULO in Portugese 30 May 84 p 7

[Text] Brazil and the PRC yesterday signed a memorandum of understanding on cooperation in the nuclear energy field. The document was signed by Brazilian and PRC Foreign Ministers Ramiro Saraiva Guerreiro and Wu Xueqian, in the presence of Presidents Figueiredo and Li Xiannian.

The memorandum, the first of the type signed by the PRC with a Third World country, will facilitate in the future the establishment of an agreement with the same objective with other countries facing problems in the supply of energy for their development.

According to members of the presidential delegation, the importance of this document lies in the fact that the two countries "seek an autonomous training" in mastering nuclear technology "for peaceful ends," a technology currently controlled by the great powers. Brazil and the PRC are not signatories of the Nuclear Nonproliferation Treaty.

The document specifies that the areas of cooperation will probably include basic research on the peaceful uses of nuclear energy, technology relative to research, planning, construction, and operations of nuclear plants and research reactors, technology for the prospecting and reprocessing of uranium, production of fuel elements, regulation and research for nuclear security, and production and the use of radioisotopes in areas of mutual interest.

According to the terms of the memorandum of understanding, the two countries will exchange knowledge and information in the nuclear field, which will open the doors, in the future, for an exchange of technologies.

Saraiva Guerreiro signed other agreements as well with the president of the State Science and Technology Commission. Among these agreements stands out a multisector supplementary adjustment to the Scientific and Technological Cooperation Accord which was put into effect only 2 months ago, although it was signed in 1982. In this agreement the two countries agreed to intensify their cooperation in the areas of agriculture, livestock, fish culture, silviculture, health, electricity, microelectronics and computers, space, and standardization.

It will be up to the Brazilian-PRC Joint Commission for Scientific and Technological Cooperation to establish concrete projects of cooperation in specific areas. Moreover, a supplementary protocol to the trade agreement between the two countries was also signed.

Brazil and the PRC will complete in August 1984, 10 years of the resumption of diplomatic and commercial relations, severed by Brasilia after the March 1964 movement.

Regarding bilateral talks with Beijing, Brazil intends to even the trade balance between the two countries which last year presented an unfavorable balance to Brazil of $233 million.

Among the matters discussed by Brazilian and PRC economic authorities, a transport agreement stands out. By this agreement, Brazilian ships will carry iron ore to the PRC and will return with petroleum and coal. The Brazilian Government has decided to offer planning and equipment for the construction of the Tianshengqiao hydroelectric dam in exchange for the supply of PRC petroleum. Moreover, it was announced in Beijing the formation of a binational enterprise for the exploitation of wood in Manaus, while the creation of another enterprise for the extraction of iron from the Timbopaba mine is under study.

CSO: 5100/4131

TA KUNG PAO ON PRC STRATEGIC MISSILE FORCES

HK130520 Hong Kong TA KUNG PAO in Chinese 13 Jun 84 p 2

["Political Talk" column by Shih Chun-yu: "China Has Organized Strategic Rocket Units"]

[Text] A Range of 13,000 Kilometers

It was reported in Beijing that in a talk to a XINHUA reporter, a senior PLA official disclosed that China has organized strategic missile units. Strategic missile units refer to intercontinental ballistic missile units. This shows that China possesses strategic nuclear weapons and the means of delivery which can be used to launch long-range missiles (with a range of 13,000 kilometers) to other continents of the world.

In fact, as early as 1980, China successfully conducted an experimental launching of a long-range carrier rocket, namely, an intercontinental ballistic missile. In 1981 China again successfully launched three satellites with a carrier rocket. At that time Western military commentators held that China not only possessed intercontinental ballistic missiles but also had multiple warheads with a long-range rocket.

Launching a Guided Missile Underwater the Year Before Last

Then, in October 1982 China again successfully launched a carrier rocket from a submerged submarine. Such modern military technology, which is extremely difficult, indicated that China had brought about a new leap in its carrier rocket technology. It not only showed China's advanced rockets but also demonstrated China's advanced technology in building submarines designed especially for underwater launching.

At the beginning of this year China again launched a positioned communications satellite accurately into a predetermined orbit synchronized with the earth so that the color television programs of Beijing's Central Television Station could be transmitted immediately to the northwest and southwest. This is an achievement in scientific space technology that only a small number of countries have mastered at present.

Judging from the series of achievements attained in recent years, it is logical that Beijing should announce the formation of strategic missile units on this occasion.

Purely for the Sake of Defense

Beijing has long and repeatedly reiterated that it is purely for the sake of defense that China has developed nuclear weapons on a limited scale. China will never be the first to use the nuclear weapons. It calls on the nuclear powers, the United States and the Soviet Union, to also undertake not to be the first to use nuclear weapons and to be the first in reducing nuclear weapons, and then to destroy nuclear weapons jointly with all nuclear countries.

During his visit to the United States at the beginning of this year and his current visit to Western Europe, Zhao Ziyang elaborated on China's stand on this issue on numerous occasions, and sincerely called on the United States and Soviet Union to resume the nuclear disamament talks.

Since Nikita Khrushchev unilaterally tore up the agreements in 1962 by recalling all Soviet experts overnight and terminating cooperation with China, Beijing has started from scratch and developed its national defense step by step through self-reliance. This achievement, which is there for all to see, is something every Chinese feels proud of.

CSO: 5100/4132

PRC TO ESTABLISH NUCLEAR ENERGY SAFETY BUREAU

HK010121 Hong Kong HONG KONG STANDARD in English 31 May 84 p 3

[Currency figures are Hong Kong dollars except where specified]

[Text] China is planning to set up a nuclear energy safety bureau to monitor the operation of the Guangdong nuclear power plant.

The proposal was disclosed yesterday at a press conference by the Vice Minister of Water Resources and Electric Power, Mr Peng Shilu, who said that the bureau would also be responsible for formulating long-term policies regarding safety standards at nuclear plants.

Mr Peng said that the government had worked out initial safety standards for the plants, based on American standards but with some amendments.

Referring to Daya Bay, he said that the contract for construction of the plant by the Joint Guangdong Nuclear Investment Company could be signed officially in two or three months.

Organisation and regulation details for the joint venture had almost been drawn up, but they would have to be examined by the Guangdong and Hong Kong authorities before the contract was signed, probably in July or August, he said.

Mr Peng added that the contract would ensure that the factory cost of nuclear power in Hong Kong in 1991 was lower than for coal-generated electricity.

He said that safety standards for the plant would be clearly specified in the contract, which he described as the most detailed and comprehensive contract yet written by China.

The basic construction of the Daya Bay plant costs about U.S. $2 billion ($15.6 billion) and the total investment by 1990 would be around U.S. $3 billion ($23.4 billion).

"China and Hong Kong would be responsible for raising U.S. $2 billion of capital and the balance would be covered by loans," he said.

Mr Peng also revealed that the board of the new joint venture company would consist of 11 members from China and six to eight from Hong Kong.

He said that the joint venture management was negotiating with three French and British companies in Hong Kong over construction contracts, and was likely to sign these contracts within a few months.

CSO: 5100/4130

UN DELEGATE CALLS FOR NUCLEAR ARMS FREEZE

Dhaka THE BANGLADESH OBSERVER in English 13 May 84 p 4

[Text] UNITED NATIONS, May 12--Bangladesh called for a freeze on the production and deployment of nuclear weapons reports the IINA.

"There can be no durable peace except through the elimination and destruction of nuclear weapons and its stock piles' Ambassador Khwaja Wasiuddin told the Disarmament Commission.

The commission, composed of all United Nations member states, was constituted by the General Assembly to consider and make recommendations on disarmament problems.

Wasiuddin said it was particularly disturbing that no meaningful negotiations were taking place in the nuclear field.

In pursuance of its commitment to general and complete disarmament, Bangladesh had acceded to the treaty on Non-proliferation of Nuclear Weapons (NPT), he said. Although more than 100 states had acceded to the treaty, it was disappointing to note that nuclear proliferation, both vertical and horizontal continued unabated.

The limitation of nuclear armaments and other weapons of mass destruction was an important first step in creating an atmosphere of trust and confidence and the relaxation of international tensions.

The Bangladesh Ambassador urged that, pending the conclusions of a comprehensive test-ban treaty, all states should refrain from testing of nuclear weapons.

Also, he said attempts to use the outer space for military purposes should be halted, and outer space declared a common heritage of mankind, to be used for humanity at large.

Wasiuddin said he was encouraged by the positive efforts already undertaken for the conclusion of a comprehensive convention on chemical weapons. The time and atmosphere had never been so opportune for achieving a major breakthrough in that field.

The huge military expenditure stood in sharp contrast to the current critical international economic situation, he said.

He urged that concrete measures be adopted to promote disarmament and to divert sources from armament to development. It was in that context, that Bangladesh Foreign Minister Shamsud Doha had proposed during the 1983 session of the General Assembly, the institution without delay of some measure of international control on all expenditure on nuclear arms.

The ambassador welcomed a French proposal to convene a United Nations Conference on the relationship between disarmament and development.

Noting that Bangladesh atached particularly importance to the question of South Africa's nuclear capability, he said it was unfortunate that the disarmament commission had been postponing adoption of recommendations concerning that issue.

"The illegal apartheid regime of South Africa, in defiance of U.N. resolutions has continued to occupy Namibia and has mounted attacks..on the neighbouring states. Its policy of aggression has not only threatened peace and security of the region but also of the whole world. Therefore, he hoped that the commission would make a greater effort to conclude its deliberations by adopting appropriate recommendations in this regard.

CSO: 5150/0023

BHABHA U-233-FUELED REACTOR GOES CRITICAL

Bombay THE TIMES OF INDIA in English 12 May 84 p 3

[Text] BOMBAY, May 11, 1984--India's first nuclear reactor using uranium-233 became critical at the Bhabha Atomic Research Centre, Trombay, at 9:05 p.m. yesterday, a BARC press release said today.

The reactor went critical with about 500 gms of U-233. The approach to criticality was as predicted by theoritical calculations, the release added.

U-233 is a man-made fissile isotope of uranium produced by irradiation of thorium in a reactor. It is then chemically separated jut like Pu-239 is produced from uranium. This material has been produced at Trombay using the research reactor CIRUS and the reprocessing plant.

This reactor is a unique one, in the sense that it is the only operational reactor in the world using U-233 as fuel. A solution of uranyl nitrate in light water is used both as fuel and as moderator. The reactor configuration is optimised for minimum critcal mass using beryllium oxide as reflector and a zircalloy core vessel.

Owing to the alpha activity of U-233, the entire system is ncloseed in glove boxes and the solution transfered to the core vessel using a peristaltic pump. The safety system was built around the Purnima facility using the reflector drop and control blades as safety mechanisms. It may be recalled that the Purnima reactor went into operation in 1972 using PuO2 as fuel.

The reactor system was conceived and designed by a group under Dr. M. Srinivasan, head of the neutron physics division. The entire control system was designed and fabricated by the reactor control division. The fuel reprocessing division provided the U-233 as well as expertise in handling U-233 solution while the glove boxes were designed by the radiometallurgy division. The neutron detector channels were fabricated by the electronics division.

The long-range programme for nucear power in the country is expected to be based on conversion of thorium to U-233 and its uses in thermal or fast reactors. The research programme in the BARC has concentrated on problems associated with the fabrication, irradiation and reprocessing of thorium and the experimental neutronics associated with the use of U-233 in reactor systems. This reactor is the first stage in the utilisation of thorium.

CSO: 5150/0019

THREE STAGES OF NUCLEAR POWER STRATEGY TOLD

New Delhi PATRIOT in English 14 May 84 p 5

[Text] **Kamini, the uranium-233 test reactor which has started functioning at the Bhabha Atomic Research Centre, Trombay, is the prototype of India's nuclear power reactors for the next century, reports UNI.**

The successful commissioning of the tiny reactor on Thursday, also marks the beginning of country's third phase of nuclear energy development, utilising the vast reserves of thorium sands found on the Kerala coast.

The U-233 fuel, processed from the thorium sands, would sustain atomic power generation in the country at least for 100 years, according to nuclear scientists.

The nuclear power programme in the country envisages a three stage strategy. The first phase of it involves construction of natural uranium fuelled, heavy water moderated and cooled reactors producing plutonium as by-product. Kalpakkam Atomic Power Station falls under this category.

In the second stage, fast breeder test reactors (FBR) making use of a mixture of plutonium and uranium would be built. A FBR can use either plutonium or U-233 (both are fissile materials) as fuel. In addition either depleted uranium or thorium could be put into it.

While generating power, an FBR produces more plutonium (if depleted uranium is used) or U-233 (if thorium is used) than it consumes.

Since India has the world's largest thorium reserves (estimated) at 500,000 tonnes on the Kerala coast, the third stage of the nuclear programme would involve construction of thorium reactors burning U-233. (U-233 is an isotope of thorium). The fast breeder reactors of the second stage would be producing the U-233 fuel required for the third stage.

However, the small quantity of U-233 used in the Kamini reactor (500 mw) was produced by BARC scientists by irradiating thorium in researach reactors. U-233 is also known as man-made nuclear fuel or the third fuel (the other two being U-235 isolated from uranium ore and plutonium).

India is the only country known to have a major nuclear power programme, based on thorium fuel. Though years behind schedule, success in the operation of Kamini reactor, would vindicate the country's determination to have an wholly indigenous fuel cycle and generation programme.

The FBR planned at Kalpakkam as a prototype for the second stage, is expected to start functioning by the year end. It was delayed by about eight years because France backed out of a deal to supply small quantities of fuel for it.

The Indian scientists have now developed an indigenous uranium-plutoniun carbide fuel, thought to be more efficient than the French uranium-plutonium oxide fuel.

Work is already going on the designing of the 500 mw commercial fast breeder reactor.

CSO: 5150/0022

UN DELEGATE SPEAKS TO DISARMAMENT COMMISSION

New Delhi PATRIOT in English 12 May 84 p 7

[Text] **United Nations, May 11 (PTI)**—Declaring that it is 'a handful' of nuclear weapon nations who threatened the world with mass destruction, India has called for an end to the 'irrational and self-destructive' desire for nuclear superiority.

Speaking in the general debate in the Disarmament Commission, the Indian delegate, Miss Savitri Kunadi, on Wednesday said the majority of the nations became the involuntary victims of a strategy of mass annihilation.

She told the commission which opened a four-week session this week, that it was morally abhorrent that a state or a group of states should seek to pursue its national security by means which constituted a threat of mass annihilation.

The case of a total prohibition of the use or threat of use of nuclear weapons rested on strong and moral legal grounds, Miss Kunadi said.

The commission has on its agenda the arms race, reduction of military budgets, South Africa's nuclear capability, confidence-building measures and proposals concerning the relationship between disarmament and development.

Few diplomats familiar with the forum of the commission expect any dramatic results from the session which, like its predecessors is more likely to bring into focus the suspicion and distrust that, in the words of the New Zealand delegate, continue to hamper disarmament discussions, multilateral and bilateral.

The Indian delegate welcomed the inclusion of a new item-disarmament and development-on the commission's agenda.

Miss Kunadi said the catalytic effects of arms limitations and disarmament were bound to broaden the base of detente and contribute to the growth and stability of the world economy.

Miss Kunadi also touched on another item to be dealt with by the commission, namely, South Africa's nuclear capability.

She said the massive buildup of South Africa's military machine, including its acquisition of nuclear weapons capability for repressive and aggressive purposes had given yet another mension to an already volatile situation.

Miss Kunadi said the racist regime's nuclear programme had enabled it to acquire a nuclear weapon capability which was being enhanced by the continued support of its 'collaborators'. This had presented a challenge and an increasingly dangerous obstacle to the process of disarmament. It also posed a serious threat to international peace and security.

CSO: 5150/0020

WRITER EXAMINES PROBLEMS IN HEAVY WATER PRODUCTION

Bombay THE TIMES OF INDIA in English 4, 6-9 May 84

[Article by Praful Bidwai]

[4 May 84 p 1]

[Text] ALMOST 12 years since its erection began and fully two-and-a-half years after it was declared "mechanically complete" and ready to start, the Rs. 66-crore heavy water plant of the department of atomic energy (DAE), at Talcher in Orissa, has proved unviable.

The plant has failed to produce even a drop of heavy water which is desperately needed for nuclear power stations. It was meant to manufacture 62.7 tonnes of heavy water a year, or 5,225 kgs. worth about Rs. 2.5 crores or more, each month.

It is now established that the very process on which the Talcher design is based is unworkable or defective. The plant cannot produce heavy water.

The design, as also much of the plant's critical equipment, was supplied by a West German multinational chemical engineering contractor, UHDE GmbH.

According to Talcher engineers, tests and experiments conducted so far indicate that in its present state, and with the existing process, design and equipment, the plant cannot be commissioned. To compound matters further, some crucial pieces of equipment have failed too.

No one in the DAE knows what has gone wrong with the plant, or precisely where the process flaws, design deficiencies and manufacturing defects lie. Top officials of the DAE's heavy water projects (HWP) division have, therefore, no clue as to what can be done to rectify these defects, if they can at all be corrected.

Engineers at Talcher, demoralised and helpless, have all but given up on the plant. They expect it will only be a matter of time before the plant is scrapped or completely redesigned and rebuilt with foreign help.

The Talcher fiasco has further aggravated the heavy water crisis. It has put the atomic energy department's ambitious power programmes in jeopardy; for heavy water--of which roughly one tonne is needed for each megawatt of nuclear-electrical generation capacity--is a crucial component of the nuclear plan based on the Rajasthan and Madras type of reactors fuelled by natural uranium.

The Talcher facility bristles with problems at each stage. The most basic of these is that the catalyst, potassium amide--explosive when in contact with water--which is meant to enable a bithermal chemical exchange to take place between ammonia and hydrogen gases, solidifies in the vital internals, pumps and tubing of the plant, choking them and rendering the entire system unworkable.

Thus the whole scheme of gradually increasing the concentration of deuterium (a heavy isotope of hydrogen, which combines with oxygen to form heavy water) in the gas from the original natural level of about 140 parts per million to a little under 100 per cent (or by 7,000 times), fails.

UHDE, which is reponsible for the process, had had no experience with heavy water plant design before Talcher.

The process of bi-thermal ammonia-hydrogen exchange has never been used, not even tried, anywhere in the world to produce heavy water. And yet the DAE accepted the process, the design and detailed engineering.

It has now got itself into a bind: under a second agreement it signed with UHDE last year, detailed later, the DAE has precisely five months left in which to get the German firm to carry out certain basic modifications and to provide the necessary engineering services for "any other problems, limitations and inadequacies which may arise during subsequent operations in so far as they relate to process or design deficiencies".

On October 1, 1984, UHDE's liability, in any case limited to DM 1.75 million (or about Rs. 71.4 lakhs), expires.

To get the firm to provide any engineering services, new design and process problems at Talcher must first be identified. But adequate tests have not been carried out and no problems have been identified or discovered, other than the same old ones of catalyst deposition and choking of equipment.

Engineers at Talcher have been unable to control moisture inside the plant. As the 20th meeting of the heavy water projects coordination committee, held in Bombay on February 23, noted: "During the period...the moisture in the plant went up again to 300 ppm in cold towers and 500 ppm in hot column of [word illegible] 74." These levels are higher than those tolerated by the moisture-sensitive catalyst.

The Talcher plant managers have repeatedly told the DAE's heavy water projects (HWP) division headquarters that "the plant cannot be commissioned without major modifications".

According to them, the plant represents a drain on the national exchequer of Rs. 90 to 100 crores--including interest on the scores of crores of rupees that have been sunk into it over the past 12 years, and depreciations, which alone works out to over Rs. 15 crores.

Had the Talcher facility been commissioned and operated according to the original schedule, it would have by now produced about 500 tonnes of heavy water, worth about Rs. 250 crores at 1980 prices.

Now to return to the second agreement which the DAE's HWP division signed with UHDE on July 1 last year, annexure II grants UHDE an acceptance certificate "on the deemed fulfilment" of guarantees--although for reasons "attributable to both the parties, the test run could not be carried out" to determine the soundness of the plant's mechanical completion.

Annexure I admits that "for want of requisite and continuous supply of gas... the test run of the plant for the stipulated period in the contracts could not be carried out ..." but adds that "certain deficiencies relating to process/ design of the plant have been noticed."

It requires UHDE "to demonstrate the efficacies of all modifications carried out so far and to be carried out hereafter" to cope with the problem of deposit formation and choking--free of cost. UHDE must "provide the necessary engineering services for such modification ... free of cost and to overcome any other problems limitations and inadequacies which may arise during subsequent operations in so far as they relate to process or design deficiencies".

The agreement limits UHDE's liability in this respect to DM 1,748,400. This is to be provided in the form of a bank guarantee, "valid for a period of nine months after the FOB delivery of the last major equipment...or October 1, 1984, whichever is later."

This is an addition to the agreement by UHDE to share 50 per cent of the cost of diaphragm pumps, piping, etc.--amounting to DM 1,168,436, (roughly Rs. 48 lakhs).

In purely legal terms, UHDE will soon be free of all its liabilities in respect of the Talcher plant. Under the original contract, too, it was not obligated to prove the plant, if the pre-conditions for its continuous running could not be fulfilled: "...if the test-run cannot be carried out within six months from the date of notification of readiness of the plant for commissioning, the guarantees (given by UHDE) will also be deemed fulfilled and the plant shall be accepted by the buyer. If delays are caused by start-up problems of the ammonia plant, the said six-month period will be extended for a further period not exceeding four months."

All these deadlines have lapsed. Legally and formally, the Talcher plant has been accepted as complete, though it cannot run.

[6 May 84 p 1]

[Article by Praful Bidwai]

[Text] THE Talcher plant's works manager, Mr. Y. K. Bansal has been categorical in his reports: "The plant cannot be commissioned without major modifications. Since the nature and extent of modifications required to solve all the problems are not clear, (the) expected date of commissioning cannot be foreseen at this stage."

Mr. Bansal wrote this in his monthly progress report for December 1983. He reiterated it in January and February this year.

However Mr. Bansal's reports, sent to the HWP headquarters in Bombay, were completely rewritten by Mr. H. N. Kaul, senior works manager for the ammonia group.

In place of the original statement, Mr. Kaul substituted the following, ambivalent and deceptive lines: "Experiments carried out so far on test autoclave indicate that some more modifications of the plant may be required before commissioning. Further studies are in hand to assess the nature and extent of problems likely to be encountered for determining the extent of modifications."

In reality, no further studies worth the name have been undertaken or are under way to assess Talcher's problems. According to Talcher sources, none are even planned. And the plant has been long past the stage when the question could be asked if modification "may" be required; it is definitely known that severe ones are needed but not known what they will be. That is the basis on which the July 1983 agreement with UHDE was signed.

Significntly, Mr. Kaul has not been so delicately editing and rewriting Mr. Bansal's documents for public consumption or for presentation to Parliament. He was "doctoring" them for his own superiors: Mr. B. N. S. Rao, manager, planning and coordination (ammonia group), Mr. K. S. Bimbhat, director technical, ammonia group, Mr. N. Srinivasan, chief executive, HWP and Dr. R. Ramanna, chairman of the AEC and DAE secretary.

Thus, in public, the DAE has attributed most of Talcher's ills to external factors such as erratic supply of power and of synthesis gas from the FCI ammonia (fertiliser) plant adjacent to it. It is true that the highly unreliable supply of synthesis gas, the basic feed for the Talcher plant, has been a major problem. UHDE maintains that if the supply from the coal-based fertilizer plant had not been so irregular, it could have commissioned the Talcher facility. "The (Talcher) plant was started the first time in late '81," says a representative of UHDE GmbH, "and had to be shut down due to (a) power cut in Orissa, which resulted in non-availability of syn-gas form the FCI plant.

"In Spring 1984, the plant was again in operation. In this test-period it could be shown that the plant can be operated and enrichment of deuterium was

in the expected range. Again this test-period was interrupted due to non-availability of syn-gas."

However, as the DAE's own confidential documents show, Talcher's problems go well beyond the availability of synthesis gas from the FCI fertiliser plant.

To quote the confidential report of the Talcher works manager (HWP/TAL/55100/387): Deposit formation test has been done in four different conditions, which showed deposit formation with liquid cycle running above 65°C using steam at atmospheric pressure and also with passing unsaturated syn-gas even at ambient temperature...

"During (the) last test run of the plant with gas-liquid cycle running and heaters and coolers in line the ammonia coolers 75-2105 & 76-2105 were showing very poor performance. A chilled water cooler did not improve the situation in (the) third stage of enrichment."

The Talcher crisis has been building up for a long time. The first set of problems made their appearance in the very first years of construction, launched on October 4, 1972. Only one of these was not of the DAE or UHDE's making: this was the loss of two towers at sea in the midst of a storm.

The Talcher heavy water plant was originally estimated to cost Rs. 21.1 crores, half of it in foreign exchange, and to be fully commissioned within 42 months, i.e. by September 1975. However, in less than two years from the start, the cost estimates were revised to Rs. 33.66 crores, with a 55 per cent foreign exchange component.

In 1979, the cost had gone up to Rs. 50.7 crores (or 2.4 times higher than the original number) and the hard currency component to 62 per cent.

Each year after the DAE has shifted scientific forward by a year or two and put its cost estimates up by anything between Rs. 5 crores and Rs. 8 crores. The currently estimated cost is Rs. 66.18 crores, in the DAE's official documents.

This excludes both the interest cost accumulated over the years--itself well over Rs. 20 crores--and the true cost of depreciation of corrosion-prone equipment, equivalent to something like Rs. 15 to 20 crores in the aggregate. The indirect, "negative" or opportunity costs are still higher.

The delays that dogged the mechanical erection of the Talcher plant are also astounding. Thus the firming up of the scope of supplies was delayed by six months, civil construction by 27 months, equipment and piping erection by 36 months, procurement of raw materials from Indian firms by 30 months, of imported items by 18 months and instrument erection by 20 months.

These delays were one of the principal factors ensuring a cost over-run of no less than 314 per cent till date. They are directly attributable to changes in the scope or design of the project and equipment failure.

The most serious of the second set of factors has been the failure of one of the most critical pieces of equipment in the Talcher plant: expensive plunger pumps manufactured by Thyssen, West Germany. These are meant to pump a solution of ammonia and potassium amide (the catalyst) at high rates and are designed to work at different pressures, the maximum discharge pressure level being as high as 310 atmospheres.

The pumps failed in a few days during the initial trial run itself, owing to a mismatch between their plungers and packing materials. All attempts to repair these have failed and UHDE has recently agreed to replace them with diaphragm pumps, made by another European firm, Lewa. Other critical pieces of equipment, such as gas compressors, steam heaters, hot stripper nozzle, and ammonia coolers, have also proved problematic.

This has been known for more than three And A Half years. And yet, the DAE granted UHDE a mechanical completion certificate on July 1, 1983.

Earlier, in 1979, the DAE had given a clean chit to those very components of the Talcher equipment that had failed. In a confidential report, DAE officials wrote: "Most of the machines for gas compression and refrigeration are of proven type. All the machines for pumping of catalyst and ammonia solution (in other words, the plunger pumps that are now being replaced) have standby units."

Meanwhile, adequate data has not been generated to identify modifications necessary to commission the Talcher plant. It is unlikely to be generated within the next five months.

If, as seems highly probable, the DAE is left holding the sick baby without UHDE's help on October 1, what will it be able immediately to do on its own to get the Talcher plant to run? Short of a miracle, nothing. For neither the HWP division nor the heavy water group at BARC, the DAE's R&D institution, has done any work on the bi-thermal process employed at Talcher. Neither set of scientists and engineers has ever designed an ammonia-hydrogen exchange process, bi-thermal or mono-thermal, to produce even a gramme of heavy water.

Leave alone absorb the bi-thermal exchange technology (assuming it is viable in the first place), the DAE has not even acquainted itself with it.

The Talcher crisis thus poses just four options before the DAE: One, severely modify the entire process and design at an astronomical cost by going in for another foreign collaboration (possibly with UHDE again?) in the hope that it will redeem the plant; two, do so on its own, starting from scratch and building up a serious and highly talented design team which develops modifications at an even higher cost and over many years; three, shift the plant physically and wholesale next to a naphtha gas based fertiliser unit at enormous expense, and in the unfounded hope that with more reliable syn-gas supply, it could, even if badly derated, produce at least some heavy water; and four, scrap the project altogether.

According to Talcher engineers, the fourth option represents the most honest choice, but a complete loss of face for the DAE. The third option is frightfully expensive and based on mere hope. The first option is not only costly, it would also entail a loss of face. The second option has its own problems, for not only is there no heavy water design team inside the DAE competent to develop the bi-thermal process; even those engineers who were familiar with the plant's erection have all left Talcher.

Mr. B.N.S. Rao, Talcher's former chemical engineer, has been shifted to the HWP headquarters in Bombay. Mr. G. K. Menon, the plant's former project manager, has voluntarily retired. Mr. S. Fareeduddin, formerly head of the HWP division, who directly supervised Talcher, is now in Vienna.

Talcher engineers strongly feel that unless the men who were responsible for the fiasco are made accountable, sent back to Talcher, and made to help commission the plant, there is no possibility of the entire mess being cleared.

[7 May 84 pp 1, 9]

[Article by Praful Bidwal]

[Text] SERIOUS waste disposal problems created by a massive accumulation of toxic chemicals produced in the generation of hydrogen sulphide gas have all but crippled the working of the DAE's Kota heavy water plant in Rajasthan.

Hydrogen sulphide, the poisonous gas with the characteristic smell of rotten eggs is, with steam, a vital input of the heavy water. The process employed at Kota is based on bithermal chemical exchange, in pairs of hot and cold towers, between hydrogen sulphide and water.

The waste disposal problem has combined with numerous other snags that have beset the Kota plant to cut its total cumulative output of heavy water so far to a pathetic 5.2 tonnes, most of it in the just-ended financial year 1983-84.

The capacity of the Kota facility is 100 tonnes a year.

Among the serious problems that have afflicted the plant are faulty boosters (needed to build up the pressure of hydrogen sulphide gas), defects in the exchange towers, numerous leaks in the entire piping and a highly unreliable supply of power and steam from the Rajasthan Atomic Power Station, which has had the worst record of capacity utilisation amongst all nuclear reactors of its kind in the world.

These problems have proved both so abiding and so difficult of solution that an official committee of the DAE derated the effective capacity of the plant by 35 per cent.

That was four years ago, and well in advance of the full commissioning of the plant. Since then fresh problems have cropped up.

According to the original schedule, the Kota plant should have been commissioned and in commericial operation by 1976. Fully 14 years after the project was launched, it is still not fully commissioned.

DAE Document

The latest DAE document on the subject, a confidential monthly summary report states the probable date of completion (commericial operation) as August 1984, eight years behind schedule.

Meanwhile, only one pair of hot and cold exchanges towers, out of three, in the first stage of the plant is functioning. This basic defect in the first of three stages of pre-enrichment has meant that the concentration of heavy water produced is much less than designed.

This exchange section of the plant is designed to produce an enrichment of about 15 per cent which is then further raised to nuclear grade (99.8 per cent enrichment) in a vacuum distillation unit. Right now, however, the degree of enrichment in the exchange section is a poor three to five per cent, or only a third or fifth of the design level.

"The Kota plant is thus a prematurely aged and sick unit," says an HWP engineer. "Its problems began even before it reached the stage of infancy. They have continued to mount ever since."

Among the problems identified in a recent status report submitted by the Kota management to the heavy water projects co-ordination committee are defects in the crucial stripper heat exchanger units, leakages in flanged joints caused by "thermal pressures," and high levels of concentration in the effluent of hydrogen sulphide gas, to mention only a few.

Hydrogen sulphide is a highly poisonous gas: at the low concentration of only 700 to 900 ppm or less than 0.1 per cent, "it produces unconsciousness, cessation of respiration and death," to quote a DAE document.

The threshold level for eight hours is only 10 parts per million or 0.001 per cent. This imposes a limit on the plant's operation and creates new problems.

Capacity Utilisation

One reason why more problems are expected to arise and curtail the capacity utilisation of the plant to a fraction of the design level is the age of much of the equipment that has gone into the plant. The highly corrosive nature of hydrogen sulphide has further compounded this problem, leading to serious equipment failure.

For instance, the trays inside the exchange towers blew of and buckled during a test run. These expensive pieces of equipment, badly damaged in the accident, have been replaced and repaired at an enormous expense.

Originally the Kota plant was budgeted to cost Rs. 19.48 crores (about 29 per cent of it in foreign exchange). Only two and a half years later the cost estimated had leapt to Rs. 35.8 crores (now 35.4 per cent of it in hard currency.

By 1976, when the plant was scheduled to have been completed, its cost had reached Rs. 54.92 crores, or almost trebled. By 1980, Kota's cost had risen to Rs. 63.71 crores.

Cost Overruns

It is currently estimated at Rs. 71.61 crores, or 368 per cent higher than the original budget. Just the foreign exchange component of the new cost estimate exceeds the entire original projected expense[Including interest, the total cost works out to over Rs. 100 crores.

According to HWP sources, the estimates are likely to be revised upwards as the Kota plant management is on a procurement spree, buying up huge stocks of spares and equipment inventory in an arbitrary fashion.

The DAE has sought to justify the cost overruns and prolonged delays in the case of the Kota project on the ground that it uses an indigenously developed process, which required a great deal of learning by doing, involved some re-ordering of critical items and necessitated frequent changes in schedules on account of delays in procurement of equipment from both domestic and foreign suppliers.

However, "indigenous" is just about the last thing the Kota process is. The entire process and design of Kota is an exact replica of that used in the Savannah River heavy water plant in the U.S.

The American plant, with a capacity of 450 tonnes a year, was commissioned in 1951. It consisted of a battery of rows of hot and cold exchange towers in the pre-enrichment stage. DAE engineers, who had managed to obtain flow diagrams and design sheets of the Savannah River plant in the mid-sixties, merely truncated some row modules in the battery and reproduced the drawings of a single row consisting of three stages to claim that they had developed the process indigenously.

BARC's heavy water section even built a laboratory-scale plant, with towers of six inches diameter simulating the 4.5 metre diameter real exchange towers, to "prove" the point.

Yet, when it came to designing and making the crucial internals of the towers, such as trays, the DAE had to turn to the U.S.-based multinational, Union Carbide.

Foreign Suppliers

The DAE has continued to be dependent on a number of consultants and foreign suppliers since. However, no amount of equipment reordering and rectification or inventory build-up could help the HWP division of the department to lick one of the most basic problems of Kota: erratic, inadequate and highly unreliable supply of steam and power from RAPS to which the plant is tied.

The Kota plant is extremely energy-intensive, and needs, 4,560 kWh per kg. of heavy water, four times as much as does the Talcher plant.

Its equlibrium time (for initial start-up) is as long as 42 days--as against 24 days for the other heavy water plants in the country. The equilibrium time for start-up after a long shut-down is about seven days and a brief shut-down of, say, 24 hours, is four days--two to four times longer than for the other heavy water plants.

What this means is that if the working of the Kota plant is disrupted even for a few minutes on account of a power failure (of which RAPS has on an average one every fortnight) or steam supply breaks (much more frequent), the whole system goes back to square one and takes four to seven days to regain equilibrium which is liable to be interrupted again in another six to ten days.

This one-step-forward-two-steps-back pattern has had a particularly damaging effect on Kota in recent months since unit 1 of RAPS has been shut down for an indefinitely long period of time and may even be scrapped, according to some reports.

Under these conditions, it is impossible for the Kota plant to meet even a third of its production target, even if its equipment is in perfect shape, which it is not.

The DAE has now found a simple solution to the problems of steam and power supply. It has decided to An- power supply. It has decided to build another plant, based on the same process, at Manuguru in An-steam boiler/

The cost of the Manuguru plant, with two units of Kota's capacity, will be a whopping Rs. 421.6 crores, i.e., about 11 times higher than the original projected cost of Kota, tonne for tonne, and three times higher than the latest cost estimate per unit of capacity for the Rajasthan facility.

Heavy water produced at Manuguru will cost, even if the plant works at 50 per cent of its capacity, over Rs. 15,000 per kilo--or about six times higher than the cost assumed by the DAE in calculating the economics of its nuclear power stations.

What amazes the HWP division's own engineers is that the DAE launched the Manuguru project and obtained New Delhi's sanction for it in September 1982--several months before the Kota plant had produced a drop of heavy water in its enrichment section, well before the process had been proved as technically viable and commercially feasible, and years after the plant was recognised as bristling with problems.

The Manuguru plant will thus necessarily replicate all the design deficiencies and manufacturing defects of the Kota plant.

Meanwhile, the Kota facility has not even been fully commissioned, solutions to its many problem--both basic and those likely to be encountered in steady working for long stretches of time--have not even been conceived, let alone identified and implemented.

Those responsible for the travails of Kota, its remarkable cost overruns and its unconscionable delays have all been transferred to the HWP headquarters. The problems-ridden plant is the charge of relative novices. It is yet to be fully commissioned.

Had it been commissioned and operated on schedule, the Kota plant would have by now produced nearly 800 tonnes of heavy water, worth Rs. 400 crores. It has so far produced only about one-one hundred and fiftieth of that amount, or a miserable 0.6 percent.

[8 May 84 pp 1, 9]

[Article by Praful Bidwai]

[Text] SIX years after the DAE's Tuticorin heavy water plant went into "commercial operation", and four years after the Baroda plant finally went on stream following five major breakdowns the two units are yet to be stabilised.

The two plants continue to be plagued by serious technical snags and problems which have ensured that their output does not exceed more than a fifth or at best, a third of their capacity--67.2 and 71.3 tonnes a year respectively in Baroda and Tuticorin.

As far as engineers of the DAE's heavy water projects division go, these remarkably low levels of capacity utilisation and the persistence of unsolved problems both reveal that the department has failed to absorb the borrowed technology of mono-thermal ammonia-hydrogen exchange on which the Baroda and Tuticorin plants are based.

However, according to the DAE's secretary, Dr. Raja Ramanna, the department has "broken the back of their problem," and the Baroda and Tuticorin plants have each been producing about 2.5 tonnes of heavy water a month over the recent past.

Even if true, these figures would represent a capacity utilisation rate of less than 50 per cent (43.3 per cent to be precise)--hardly a sign of stabilised production during the peak period of the plants' life.

As it happens, however, the performance of Baroda and Tuticorin has in reality been even worse. According to the DAE's own classified documents, the two plants together produced on an average less than 3.5 tonnes of heavy water during the reference period (November 1983 to January 1984) that Dr. Ramanna was commenting upon.

This represents less than a poor 30 per cent capacity use level, and a larger discrepancy of 30.8 per cent between facts and Dr. Ramanna's claims. The picture is much worse, if a longer period of time is considered.

In the financial year 1983-84 as a whole, the Baroda plant produced 13.6 tonnes of heavy water, or used only 20 per cent of its capacity. During the same period, the Tuticorin facility worked at about a third of its capacity.

And yet the financial year just ended has been the best single time-span in the combined history of the two plants. Never earlier had the two factories run simultaneously for any length of time. And never earlier had the Baroda plant produced as much heavy water. In 1983-84, even Tuticorin exceeded its earlier levels of output, 13.58 tonnes in 1980-81 and 15.60 tonnes in 1981-82.

The Baroda plant is now closed: it has taken a six-week-long shut-down to effect a replacement of 13B1 catalyst and carry out tower maintenance.

The Baroda heavy water plant has had a long and eventful history, marked by numerous disasters. The process it uses was designed by Gelpra, a French-dominated consortium of European countries which had set up a small (20-tonne-a-year) plant at Mazingarbe in France in 1967, only about two years before construction began on the Baroda plant.

The commissioning of the plant, which is attached to the fertiliser factory of the Gujarat State Fertiliser Corpn., from which it draws its supply of ammonia synthesis gas, was started in May 1975--a delay of 22 months on account of stretched erection schedules. The commissioning, which was to be completed within two and a half months by March 1973, was actually finished in July 1977--52 months behind schedule.

Manufacturing Defects

By this time the Baroda plant was already in trouble: sealing rings in high pressure ball valves had failed, rotors and canned motor pumps in exchange towers had malfunctioned, the catalyst, again potassium amide, had leaked, the vital ammonia converter had developed dangerously high temperatures. To cool this last item, Gelpra and HWP engineers devised two "quench blocks" made of special steel.

AT 4:30 p.m. on December 3, 1977, when the Baroda plant was almost ready to start production, one of the quench blocks exploded violently, extensively damaging parts of the plant and necessitating a three-year-long shut-down and an expense of nearly Rs. two crores.

The accident showed that the plant had been seriously under-designed and had several manufacturing defects and equipment failures many of which could be attributed directly to the extraordinarily high pressures that are part of its operating conditions.

These pressures, 600 to 650 atmospheres are rarely used in any chemical process without risking serious, potentially explosive, leaks and breakdowns.

Baroda's old problems remain with it. Among the most important of them are those relating to the cracker, pressure valves and glands, the ammonia converter, all manner of pumps and compressors--to take only a few random examples.

To quote a recent monthly report of the Baroda works manager, which lists some reasons for a shortfall in production:

"Emergency shutdown of primary enrichment unit and main cracker at 1000 hrs. on 1-2-84 on account of abnormal sounds (due to back firing in burners from cracker. D2 burning remained stopped from 100 hrs on 1-2-84 to 1730 hrs. on 2-2-84...

"Shutdown of 20K41 on two occasions for a total of 105 hrs. of 20K42, once for 6 hrs. of 19K3, once for 3 hrs. and of 20K5 twice for a total of 106 hrs. (once for maintenance for 59 hrs. and for second time for 57 hrs. and for second time for 57 hrs. on account of shut down of 20K41).

"Reduced catalyst feed to T1 on two occasions for a total period of 83 hrs. due to maintenance of 22P41/42.

"Less reflux to T1 due to drawal of ammonia for test commissioning of Pilot Plant.

"Bypassing of feed gas @ about 3.5 T through 12HCV 7 and 11 DR 60..."

Or to cite another recent document (8000K/HWP(B)/S/42):

"Potassium amide is used as a catalyst for the isotopic exchange between ammonia and hydrogen at Heavy Water Plant (Baroda). Hydraulically driven (oil) reciprocating plungers pumps supplied by M/s. Burkhardt are in use for pumping of potassium amide solution.

"Since the time of commissioning of the plant, several serious problems have been faced on these pumps affecting very adversely the production of heavy water. One of the most serious problems is the heavy loss of seal oil through the packings of the pump which ultimately goes to the process side. Theoretically though an arrangement is existing for separation of leaky seal oil and ammonia from each other, it has been experienced taht the arrangement is not effective in spite of best efforts and maximum loss of seal oil is in mixing with the process stream of potassium amide solution in the suction stroke of the pump and going to the isotopic exchange tower 12T1.

"Problems have been faced on 22P4 pumps also due to frequent maintenance for replacement of packings, shafts, seal oil pump, leakage of suction and discharge flanges, high oil & ammonia consumptions, heating of suction and discharges lines, gland leakages of discharge valves, etc. It has been experienced that out of the three pumping units of 22P4 installed, mostly only one is available for process with other two under maintenance. The available pumping capacity for one unit is only about 0.9 T/Hr. against a design of 1.4 T/Hr due to a high seal oil/ammonia leakage."

These examples can be multiplied, The Times of India has in its possession two recent documents written by the Baroda management, which are a long wail of complaints about the persistence of numerous snags in the plant.

The Tuticorin plant has hardly lagged behind Baroda so far as technical snags and difficulties go. The facility is linked to the fertiliser plant of Southern Petrochemical Industries Corpn. (SPIC), adjacent to it, which

supplies the synthesis gas used in the Tuticorin process. It was set up in collaboration with Gelpra and in principle is almost identical with it, except that it uses a lower--although in absolute terms still very high (200 atmospheres)--pressure, has larger exchange towers and needs extra refrigeration.

Tuticorin's time schedule for erection was delayed by 30 months (in addition to the budgeted ten) and that for commissioning by eight months. The plant, admit several DAE documents, is full of snags and has had hundreds of interruption in its running, only a minority of them due to irregular supply of synthesis gas from SPIC.

The heart of the plant, and of its welter of problems, is the cracker. Between September 1977 and October 1982, that is in just five years, the unit had as many as 167 shutdowns most of the "of crash nature", in the words of a DAE review committee.

One instance of the serious nature of Tuticorin's problems is an accident that occured in the cracker on October 17, 1982. To quote verbatim from the Tuticorin Log Book of that day:

"At 0920 hrs. a sharp rise in main cracker temperatures were observed. As per the instructions of panel operator, the field operator rushed to site and cut off four burners on the top row corners.

"Meanwhile at the bottom of the cracker the tail of extreme SW tube was found red hot and fire was observed round the annular space between this tube and cracker casing. Field operator on the instructions of u/s (the undersigned) who by the time rushed there, isolated all the bottom row naphtha valves and the burners were cut off.

"Trials were made to quench the fire with sand etc. but within few minutes almost whole of the cracker caught fire. Lengthy flames were observed especially at the south-west corner top and flame was also coming out from 16K5 discharge. Three times mild explosion sound was also heard from inside of the cracker.

"Left with not other alternative, u/s (the log book writer) pressed the "general emergency shut-down" 'Gelpra Plant' in the field.

"12 FCV 91 & 12 isolation valves were closed. Naptha filter isolation and bypass valves were closed, naphtha pump stopped. 12 PVC 94 was closed, 12 HCV 97 a & b opened. Steam to furnace was opend. 12 P 61 & 62 pumps were isolated.

"For nearly two hours water was poured on the cracker from all sides by HWP firemen and SPIC fireman.

"Braving the still hot cracker the peepholes doors were opened at the bottom two rows. A streak of fire was still glowing along a tube inside the furnace. Water cooling was kept on and later all the peep holes doors were opened, all the individual naphtha burner valves were closed.

"Before the abrupt temp. rise in the cracker all the parameters were maintaining normal. Cracker liq. feed was 14.5 T/Hr."

What makes this disastrous accident singular is the fact that it took place in perfectly steady, "normal" operating pressures and temperatures "far below the operating limits prescribed by the manufacturer as well as the design operating parameters", in the words of the report of a five-member DAE committee which investigated into the failure. Thus the feed to the cracker, flue gas temperature, outlet gas temperature and outlet pressure or maximum steam wall temperature were all well under the design and operating limits.

The cracker tubes had been in service for less than 25,000 hours while their design life was one lakh hours at a pressure of 160 kgs/sq.cm at 765°C (The actual pressure and temperature before the fire were 127 kg./sq.cm. and 705°C).

The committee investigating the accident recommended certain limiting pressures and temperatures at the cracker skin for reasons of safety. These are now being violated in the cause of higher output from the Tuticorin plant. This is true of Baroda as well.

The problem that bedevil both the Baroda and Tuticorin plants are of a basic character, related to design of major equipment failures, and far from peripheral. Irregular supply of synthesis gas is only a minor part of the trouble. HWP engineers see no realistic solutions to the basic problems, partly because there is very little experience of the mono-thermal process itself anywhere in the world. It is not yet stabilised and snag-free.

In fact, over 93 per cent of the world's heavy water plants use the hydrogen sulphide-water process.

India is the only country with a significant heavy water programme which has relied on the mono-thermal process for a major chunk of its projected output of the nuclear material.

Baroda and Tuticorin are now almost past their prime: the design life of these highly corrosive-prone, high-pressure plants is about 15 years.

[9 May 84 pp 1, 9]

[Article by Praful Bidwai]

[Text] IN addition to the Rs. 220 crores (with interest, nearly Rs. 400 crores) that have been invested into the Talcher, Kota, Baroda and Tuticorin heavy water plants over the years as their capital costs, the DAE spent an estimated Rs. 88.6 crores in 1983-84 for the "purchase and acquisition of heavy water", i.e., imports. In 1982-83, a sum of Rs. 59.4 crores was spent under this head. (Code 2.4.8 in the "Performance Budget for 1983-84").

What has been the net benefit from this enormous capital expenditure? According to the DAE's own documents, all its heavy water projects put together

earned an estimated revenue equal to the grand sum of Rs. 4 crores in 1983-84, the same as in 1982-83 and slightly lower than the Rs. 4.45 crores earned in 1981-82.

What is more, the biggest chunk of this money is estimated to have been accounted for not by the four big projects discussed so far, but by the tiny (14 tonnes/year) cold heavy water plant at Nangal, based on the expensive, highly energy-intensive and outmoded hydrogen electrolysis and distillation process. Nangal, designed by Linde, a German firm, has maintained a fairly steady output of 10 to 12 tonnes a year since 1962. It is the primary source of indigenous heavy water in the country.

The other four plants, with a total capacity of 301.2 tonnes a year between them, have so far yielded less heavy water than has the 14 tonnes-a-year Nangal. Their cumulative capacity utilisation does not even add up to a significant figure.

After mechanical completion, Kota has worked at under five per cent, Baroda at about ten percent, Tuticorin at under 20 per cent and Talcher at zero per cent.

None of them has so far shown any signs of stabilising. All of them continue to be badly crisis-ridden. The pre-enrichment section of Kota is supposed to produce a concentration of 15 per cent. It produces only three per cent.

Both the Baroda and Tuticorin plants are designed to produce nuclear grade (99.8 per cent enriched) heavy water. However, they produce no such material. The product is suboptimally tapped from them at 30 or 40 per cent enrichment and is further concentrated in specially set up and expensive distillation facilities.

More Plants

These upgrading units, which were originally meant only to concentrate heavy water degraded through use in power reactors, are now being set up at the cost of Rs. 1 to 2 crores each as an adjunct of the heavy water plants themselves. The process of upgradation consumes enormous quanitities of power, and to HWP engineers at least, it is unclear how long it will take the DAE to replenish all the electricity it has so far consumed to build power and heavy water plants and upgradation facilities.

What is even more amazing, the DAE is now launched on the course of building exact replicas of its own sick heavy water plants, even before any of them has been demonstrated to be truly viable and stable.

The DAE is proceeding to build the Manuguru plant (based on the Kota process, but double its size) in Andhra Pradesh, in addition to a monothermal ammonia-hydrogen exchange plant (effective capacity 110 tonnes) at Thal-Vaishet in Maharashtra, adjacent to the large RCF (Rashtriya Chemicals & Fertilisers) fertiliser plant that is now being constructed.

The Rs. 188-crore Thal plant, replicating the Tuticorin unit, is actually being built for the DAE by RCF, which has had no experience of heavy water production technology or plant construction so far. Under a presumed agreement, which has not even been signed yet, the DAE has doled crores of rupees to RCF. RCF will farm out the detailed engineering work to the Italian-owned Haldor Topoe.

Thus RCF is the contractor, Who is the designer of the Thal heavy water plant? Strangely, none other than the DAE itself. But the Thal plant "design" is no more than the set of drawings that DAE obtained from Gelpra consortium. These are being sent to its "consultant", PDIL, Sindri, (which again is not acquainted with heavy water).

PDIL actually does no more than trace out the drawings and translate the scanty technical writing on them from the French into the English.

These are sent back to the "designer" who in turn forwards them to the "contractor". Thus the charade goes on. The fact is that the DAE, or HWP does not only not have anything like a design cell for heavy water, but has never come anywhere near designing a heavy water plant.

It does not even have the full design specifications of the Tuticorin plant, which Thal is to copy.

This crucial fact is confirmed by the report of a five-member official committee set up in 1980 by the DAE to choose an appropriate processes and technology for new heavy water projects to be set up in the country.

The Fareeduddin committee's report states (p.26): "The design and engineering is not available" for the ammonia-hydrogen (monotherm) process used at Tuticorin and Baroda. Hence "it is desirable to go in for foreign collaboration. It has been examined that in case we have to perforce go on our own, some engineering data will have to be generated and some equipment developed. This may add one to two years to the project completion time."

Again on p. 24, the report says: "Though the process know-how, design and engineering are not available, by resorting to some developmental work and by taking guidance from the available engineering information, most of the equipment required for the plant can be duplicated indigenously and balance can be imported. Some difficulties may arise in duplicating the plant indigenously, but the same can be overcome through close co-operation and pooling up of indigenous expertise. In such a case it may take one to two years' more times to complete the plant."

None of the necessary developmental (R&D) work has been done, nor has "indigenous expertise" been mobilised. The Thal design remains essentially incomplete.

How then is the "designer" going to complete the job? Going by the answers given by the HWP engineers, basically by a little guesswork here, a little approximation there? And perhaps by going in for some desperate solutions or foreign collaboration, ultimately.

The Thal plant will, on present estimates, cost the exchequer Rs. 187.7 crores, one-third of it in foreign exchange. Per tonne of capacity, the capital cost works out ot Rs. 1.71 crores--or three and a half times higher than Tuticorin.

If the plant runs at an optimistic 50 per cent level of capacity use, its product will cost upwards of Rs. 10,000 per kilo--probably the highest cost of production for the commodity anywhere in the world. Except Manuguru where, thanks to the captive steam and power plant, the currently estimated capital costs are an astounding Rs. 2.1 crores per tonne of capacity.

Heavy water from such frightfully expensive plants will alone add a rupee or more to the annualised (interest and depreciation) cost per unit of electricity generated in nuclear power stations and render the latter uncompetitive vis-a-vis any other source of power.

The DAE top brass has no control over the schedule of construction of its new projects or over the operation of its plants. The heavy water board, recently reconstituted under the HWP chief executive, Mr. N. Srinivasan, (rather than under the DAE secretary's chairmanship, as it used to be) sets all production targets arbitrarily. It revises them equally arbitrarily.

Thus it set a target of 4.335 tonnes per month for the Baroda plant last year, only to revise it to 3.6 tonnes half way through the year.

Or to take another instance, in its 44th meeting, the heavy water board observed that the production of heavy water at Baroda and Tuticorin "has been lower than the projected figure" and wanted the "anticipated production figures" for 1984-85.

Pat came the following answers: Baroda: 40 tonnes, Tuticorin: 30 tonnes (if the cracker improves, then 40 tonnes) Talcher: 20 tonnes (!) Kota: 20 tonnes (subject to steam availability from RAPS-II).

The projections are discarded as casually as they are made. They are equally cavalierly re-set too. For instance, the Baroda target of 40 tonnes was set as long ago as in 1980-81. Actual production has come nowhere near even half the level. But the same target has been re-set for 1984-85.

Since all such projections are casual and arbitrary, the local plant managers tend to treat them rather lightly. Half their reports start by blaming the supplier of synthesis gas or steam and end up by asking for more money with which to buy new equipment.

The most bizarre instance of this is the Talcher management recently asking for another Rs. 20 crores for modifications to the plant that could get it working--without even specifying precisely what it proposes to do with the enormous sum of money.

The vast majority of HWP engineers appear to be demoralised and without spirit. Most have no hope left in the future of the heavy water programme.

Some are already asking why there should not be an embargo or freeze on all new heavy water projects, including Thal and Manuguru, until the existing plants are fully commissioned, proved and stabilised.

Meanwhile, the DAE is busy trying to obtain the Centre's sanction for yet another heavy water project, to be located at Hazira in Gujarat, and based on the Thal ammonia-hydrogen mono-thermal exchange process.

CSO: 5150/0016

FUEL FOR NUCLEAR REACTOR FROM KERALA SANDS

Bombay THE TIMES OF INDIA in English 8 May 84 p 1

[Text] NUCLEAR scientist in Bombay have built a new atomic reactor using a man-made material processed from the thorium sands of the Kerala coast.

The tiny reactor, named "kamini," which will use uranium-233 as fuel is the precursor of future power reactors that will produce power as long as the thorium supply from the Kerala sands lasts.

The development of the U-233 reactor, an important milestone in the atomic energy development, was revealed at a press conference by scientists of the Bhabha Atomic Research Centre (BARC), Bombay, here today.

BARC director, Dr. P. K. Iyengar, said the reactor, which would use about 500 grams of U-233, would be commissioned at the Kalpakkam research centre, near Madras, in the next three months.

Dr. Iyengar said that U-233 was produced by irradiating thorium in research reactors in Trombay during the last few years.

U-233 is also known as the third fuel. Other than plutonium and uranium-233 (which is naturally present in minute quantities in uranium ore), U-233 is the only fuel that has been used in nuclear reactors.

At present, there is no commericial reactor based on the third fuel, but India's nuclear programme for the next century is based almost entirely on U-233 and thorium.

Soviet Offer

The building of an experimental U-233 reactor is considered a major achievement, as separation of this material from the irradiated thorium and fabricating it into fuel requires great technological skill.

The Times of India News Service adds:

India will accept the Soviet offer of light water nuclear reactors if the terms are satisfactory, both financially and politically, according to Dr. Raja Ramanna, chairman of the Atomic Energy Commission.

He said at a press conference that the only safeguards India could accept were those which were accepted in the case of the Tarapur and Rajasthan atomic power projects.

India was planning to build 10,000 MW capacity of nuclear power by 2000 and a foreign proposal could be of help only if there was some delay in the indigenous programme and the country wanted additional power in a hurry.

He pointed out that the Soviet offer was for enriched uranium-fuelled reactor, while India's own programme was based on natural uranium and heavy water. The terms offered by the Soviet Union were "good" but the deal was still being negotiated, he said.

Dr. Ramanna's reply to a question on supplies of spares for Tarapur power plant indicated that these vital requirements of this nuclear unit would be met through indigenous sources. The same applied to some other equipment such as lead-glass window--also denied by the U.S. but required by another nuclear facility.

Dr. Ramanna parried a question on the reprocessing of spent fuel from Tarapur, another contentious issue in Indo-U.S. relations, by saying "we are presently interested in reprocessing spent fuel from the Rajasthan atomic plant."

Dr. Ramanna and his team of top experts of the atomic energy department put up a strong defence of the performance of nuclear power plants and pointed out that difficulties faced in heavy water production could be traced to a complex set of circumstances ranging from imputs availability, power cuts, the plant's own engineering defects and, in one case, even the disappearance of towers in high seas which delayed the erection of the plant. Moreover, costs of learning things by oneself were also involved.

Despite these difficulties, however, the country was now self-sufficient in heavy water technology and it did not have to import heavy water barring that for the Rajasthan unit under an agreement with the Soviet Union.

Dr. N. Srinivasan, director of heavy water projects, said that contrary to what the critics of the programme believed, the Tuticorin heavy water plant was a success story. It was working at 80 per cent efficiency. Future heavy water plants would be modelled after Tuticorin.

He said the Kota heavy water plant was deliberately slowed down for technical reasons and would start full operation by October. He pointed out that with all its heavy inventory of toxic hydrogen sulphide, the Kota plant had followed the strictest environmental standards.

On the Talcher heavy water plant, he denied that the basis process was unviable, the plant had its own engineering problem but these were not difficult to solve. However, in the absence of synthesis gas supply from adjoining coal-based fertiliser plant, it was difficult to even try for solution.

The solution had been indicated by experiments but what could be done if power cuts played havoc with the fertiliser plant which was affected for three to four months every year? The plant was the first of its kind built anywhere and in a few months problems would be sorted out. A committee was examining steps to be taken, since some modifications had considerably improved the performance of the Baroda and Tuticorin plants.

Dr. Ramanna, in his initial statement, said much of the criticism of the atomic energy programme was not based on facts. He said for of the five nuclear power reactors were satisfactorily working. One of the two units of the Rajasthan plant closed for repairs was expected to be commissioned soon.

The performance of the first unit of the Madras atomic plant project was very satisfactory and the second unit was expected to be commissioned next year.

The fast-breeder test reactor, which would be fuelled by a carbide of plutonium and uranium, was to be commissioned by year-end.

Dr. Ramanna did not agree with the view that the target of 10,000 MW of nuclear power by the end of century was very ambitious. He said the gestation period could be cut down if nuclear power plants were ordered in a bunch.

In reply to a question, Dr. Ramanna said a separate nuclear power board was being set up and it would report to the Atomic Energy Commission. This was intended to speed up the execution of power projects which was undertaken now by a separate division in the department.

Dr. M. R. Srinivasan, director of this division, said the first 12 or so units could be of 235 MW size and another ten units of 500 MW each. The units could be in clusters so that time on building infrustructure could be cut down.

Nuclear Graveyard

He said the Narora atomic power plant had been delayed because of design modifications. The first unit was now expected to be commissioned by the end of 1987.

P.T.I. adds:

Dr. Ramanna said ten per cent of all electricity produced in India in 2000 would come from nuclear plants.

Dr. Ramanna and his four-member team who flew in here to counter the adverse press reports on the AEC's heavy water plants, faced a barrage of questions mostly on the long delays of nuclear power programme.

Dr. Iyergar revealed that the Kolar gold mines in Karnataka were being explored as a possible site for permanent burial of radioactive wastes produced by the AEC facilities.

He said a technology had been developed to contain the wastes inside vitrious glass encased in steel and concrete containers.

In this form, the wastes could be safe for 25 years but for long-term storage, studies were going to assess the suitability of the gold mines as a nuclear graveyard.

Dr. Srinivasan said no date could be given for the recommissioning of the first unit of the Rajasthan power plant that had been shut down for over two years owing to leakage at the end shields.

He said the defect had been located, the solution found and the plant "will be commissioned soon".

CSO: 5150/0017

BRIEFS

N-PLANT DETERIORATION DENIED--NEW DELHI, May 2--Technology for use of thorium as feedstock for breeding in atomic reactors has been developed, the Minister of State for Science and Technology, Mr Shivraj V. Patil, told the Lok Sabha today in a written reply to Mr A. K. Roy, report PTI and UNI. Replying to another question he denied that there was a steady deterioration in the performance of nuclear power plants, especially those using natural uranium. Mr Patil said Unit-I of the Tarapur atomic power plant was currently operating at a power level of 135 MW. Unit II, which was under refuelling outage, had also resumed operation. [Text] [Calcutta THE STATESMAN in English 3 May 84 p 9]

KALPAKKAM REACHES PEAK--MADRAS, May 8--The 235-MW unit of the Madras Atomic Power Station at Kalpakkam, which began commercial operation in January this year, has achieved its rated generating capacity. The plant is producing over 5.5 million units (kwh) a day. The rise to the peak output has come in measured increments since the plant came to life on July 23 last year with a burst of 30 MW. After statutory tests and performance checks-the clearance of the Safety Review Committee had to be obtained each time output was raised-the power level was taken to 200 MW before the unit was declared commercial on January 26. The 100 per cent output was touched on Monday after more than 30 days of uninterrupted operation. The atomic station has so far supplied more than 510 million units to the Tamil Nadu grid, 335 million units since January 26 at 38 paise a unit, the price the Tamil Nadu Electricity Board pays for power from the Neyveli Lignite Corporation. The rate, however, is said to be only tentative; the firm price is to be announced by the Centre. The second 235 MW unit at the plant is likely to be commissioned in June next year, according to current indications. [Text] [Madras THE HINDU in English 9 May 84 p 12]

TARAPUR UNITS' LIFETIME--Bombay, May 12 (PTI)--The two units of the Tarapur atomic power projects have registered a life time capacity of 50 per cent despite their old design, according to the director of the atomic power project, engineering division, (PPED), Dr. M. R. Srinivasan. Giving a talk on the country's achievements in the field of atomic energy here yesterday, Dr Srinivasan said the old design of the reactor necessitates shutting it down for three months each year for refuelling. "This means that nearly 25 per cent of the non-availability of 50 per cent of the power is inherent", he added. He said the life time capacity of nuclear reactors in the US, which is in the forefront in the atomic power field, is 60 per cent. Unit two of the Rajasthan atomic power plant registered a capacity of 62 per cent in 1983-84, he said. [Text] [New Delhi PATRIOT in English 13 May 84 p 5]

SELF-SUFFICIENCY IN URANIUM CLAIMED--The chairman of the Atomic Energy Commission, Dr Raja Ramanna, said India has become self-sufficient in uranium and heavy water. Laying the foundation stone for the laboratory of the atomic mineral division at (Nagarabhavi) near Bangalore in Karnataka, he stressed the need to set up exploration of atomic minerals, particularly uranium. He said import of uranium is not possible under the present international regulation. Keeping in view the country's power needs and the nonuranium sources, the target of 10,000 MW of nuclear power have been worked out for the end of the century. Dr Ramanna said nuclear power now contributes 3 percent of the total electrical capacity in the country. Generation would reach 10 percent with the proposed setting up of 20 nuclear power reactors in different parts of the country. [Text] [BK040930 Delhi Domestic Service in English 0830 GMT 4 Jun 84]

CSO: 5100/4727

IRAN-FRENCH DISPUTE ON URANIUM ENRICHMENT PROJECT ELABORATED

Paris AN-NAHAR ARAB REPORT & MEMO in English Vol 8, No 13, 14 May 84 pp 10-11

[Article by Randa Takieddine]

[Text] The long drawn out dispute between France and Iran over the latter's financial support for the Eurodif uranium enrichment project has seen another turn with the issue once again referred back to the Court of Appeal.

In its judgement on March 13, details of which have just become available, the Cour de Cassation reversed the April 1982 decision of the Paris Court of Appeal to unblock interest payments – currently estimated at $540mn – due to Iran on a $1bn loan to France's Atomic Energy Commission (CEA). The Cour de Cassation has referred the case back to an Appeal Court outside Paris, because the Paris court failed to make a proper distinction between funds which were protected from seizure and those which were not.

The issue goes back to the Shah of Iran's decision in 1975 to launch a massive nuclear energy programme requiring 40 nuclear power stations to be built. To provide the necessary fuel for the plants, Iran sought membership of Eurodif, the European consortium set up to provide uranium-enrichment services at its plant at Tricastin in southern France.

The original members of the consortium were France, Italy, Spain and Belgium. It was agreed that Iran should enter Eurodif after setting up a partnership with France, the major shareholder in the consortium. The vehicle for this partnership was Sofidif, in which the French CEA held a 60 per cent share and Iran's Atomic Energy Organisation held 40 per cent worth $1bn. Sofidif in 1975 acquired a 25 per cent share in Eurodif (giving Iran an effective ten per cent share in Eurodif).

Iran's $1bn share in Sofidif was in the form of a 15-year loan, on which Sofidif would pay interest. At the same time Iran and the other members of the larger consortium were making payments into Eurodif to help finance the scheme. The payments were regarded as forward purchases of uranium-enrichment services, which would become available from 1981.

In 1980, the year following the Shah's overthrow, Iran announced the abandonment of the nuclear power

programme. It said it would no longer require enriched uranium and was withdrawing from Sofidif and, therefore, from Eurodif.

France immediately took the issue to the Commercial Court asking for Iran's assets in Sofidif to be frozen on the grounds that it had sought a unilateral change in the rules of the consortium. The French acceded to the French application and the Iranian assets in the project were frozen. France also suspended payments of interest on the Iranian loan. France argued that by refusing to buy the consortium's services, Iran would damage its partners' interests and demanded FF9bn in compensation.

In April 1982, following an Iranian application, the Paris Court of Appeal released the frozen assets declaring that state funds were immune from seizure and that Iran had the right to dispose of its assets in any way that it saw fit. It said the money was "state funds" and not "commercial funds".

The court also ordered France to pay $200mn in interest immediately but said the Iranian loan should be repaid over ten years.

In the two years since that judgement, France has not paid any interest or principal.

Announcing its decision in March 1984, the Cour de Cassation said that the Paris Court of Appeal had failed to distinguish two points: firstly, between Iran's contractual relations with Sofidif and Sofidif's obligations to Eurodif. It said the Appeal Court had confused the two obligations, which were legally separate. Secondly, the Cour de Cassation said that the original order to freeze the funds was valid if it could be shown that they were simply a commercial investment. The Court of Appeal originally decided that the money comprised state funds and was thus immune from seizure. This point will now have to be reargued in another appeal court.

A French lawyer involved in the case said the March decision "was a clever way to avoid making the payments that were due." He also said that the court had decided that damage to French interests caused by Iran's withdrawal amounted to FF4bn, less than half the FF9 bn claimed by the French CEA.

The precise attitude of the Iranian atomic energy authorities is still difficult to determine. Although the Iranian government said it had abandoned the nuclear power programme, its representatives still regularly attend meetings of both Eurodif and Sofidif.

The lawyer suggested that France was trying to prolong the issue until political relations between the two countries improve to a point where a negotiated settlement might be possible.

CSO: 5100/4730

PEACEFUL INTENTIONS REITERATED; WEST URGED TO HELP

Karachi MASHRIQ in Urdu 25 May 84 p 3

[Editorial: "Peaceful Atomic Program of Pakistan"]

[Text]

[Text] President General Mohammad Ziaul Haq has said that we have expertise to enrich uranium to fill the future needs of Pakistan. He said, by the grace of God, Pakistan is one of those countries which has the nuclear expertise and uranium it needs. He said that in order to meet our future electric power needs we are looking for technology and machinery to set up a 900 megawatt electric power station at Chashma and that we are ready to offer guarantees that this power house will not be used for manufacturing nuclear arms and that this station will be used only for producing energy.

The president then referred to the Karachi nuclear power plant which has been set up in cooperation with Canada. Suddenly in 1976 Canada stopped supplying required machinery for this power plant although the International Atomic Energy Commission which supervised it never reported any violation of international safeguards. Similarly Pakistan is also prepared to offer similar safeguards for the Chashma nuclear power plant. However, it is a matter of regret that when tenders were requested for the Chashma project last year no Western country, under pressure from the United States, made offers in this connection. Pakistan is again trying to find machinery and technology for the Chashma project.

We will succeed in this project only if the United States stops creating difficulties for us in this peaceful program of ours. Pakistan has assured the U.S. Administration that Pakistan will not manufacture nuclear arms. The U.S. Administration has also acknowledged that Pakistan will respect U.S. concern over the proliferation of nuclear arms. In spite of this it has been putting pressure on the Western countries not to supply any machinery for the Chashma project, even though Pakistan has offered to sign necessary safeguards for this project.

The United States, in fact, demands that the nuclear facilities which Pakistan has acquired by itself should be placed under international supervision. This is hardly a fair demand. Pakistan can place under international supervision only those nuclear installations which it has acquired from other countries. Those nuclear facilities which Pakistan has acquired through the expertise of its own scientists do not fall under the terms of interna-

tional supervision. Pakistan has acquired expertise in enriching uranium through the work of its own scientists. Pakistan's well-known scientist Dr Abdul Qadeer Khan has, in the *DEFENCE JOURNAL*, proudly claimed that in the technology of enriching uranium Pakistan has been able to end the Western monoply and moreover, in this particular field it has left India far behind. Pakistan has acquired this expertise in only 7 years and at much less cost. The West is annoyed that Pakistan has been able to acquire this technology through its own sources. They also fear that a country which has the ability to enrich uranium can make not only atom bombs but also hydrogen bombs. But Pakistan is offering safeguards to the entire world: Pakistan will never use the expertise of its scientists in the field of manufacturing nuclear arms. It will use this expertise only to meet its future energy needs. It is now the duty of the West to accept the guarantees offered by Pakistan and help it in setting up its nuclear power plant.

CSO: 5100/4731

AID FOR INDIAN NUCLEAR POWER PROGRAM ASSAILED

GF121830 Lahore NAWA-E WAQT in Urdu 6 Jun 84 p 3

[Editorial: "India--20 Nuclear Power Stations!"]

[Excerpts] The chief of the Indian Nuclear Energy Commission, Mr Raja Raman, laid the foundation stone of a research center at the Bangalore uranium mines and said: India has become self-sufficient in uranium and heavy water, and with 20 nuclear reactors now being installed, the percentage of nuclear energy used in power production will rise from 3 to 10 percent. These figures denoting an increase in the access to nuclear energy and technique by India are indeed impressive, but not unexpected or surprising. Both the United States and the Soviet Union have been cooperating with India in the field of nuclear energy for their own interests; India exploded its first nuclear device in 1974.

India's progress in the nuclear field is undoubtedly the result of its government's interests and the hard work of its scientists, as well as all its allies, including the United States and the Soviet Union; and with the setting up of 20 more nuclear power plants, it can be clearly seen how far India has progressed in this respect. Meanwhile, Pakistan has been subjected to opposition and a slanderous propaganda campaign.

The most preposterous reason for Western opposition to Pakistan's nuclear program is that Pakistan will manufacture an atomic bomb and pass it on to the Arab countries, which will then drop it on Israel, when the real reason for the opposition is that they cannot tolerate the fact that the Islamic world will acquire a new source of energy through Pakistan. Therefore they give us advice, directly or through Japan, to use solar energy or biogas!

Their objective is for modern technology to remain beyond the reach of Pakistan or the Islamic nations and for the developed nations to continue to exploit the Islamic nations with their superior know-how, so that the Islamic nations only remain an economic market, and do not acquire a strong defense and start dreaming of political parity and economic freedom!

CSO: 5100/4732

BRIEFS

REBUTTAL ON PRC NUCLEAR AID--Foreign Minister Sahabzada Yaqub Khan has denied the reports that Pakistan was receiving aid from China for development of its nuclear program. In an interview with BBC, he dismissed as fantasy the idea that Pakistan would benefit from the nuclear technology which China wants to buy from the United States. The foreign minister said that the China-U.S. agreement signed in April is solely a matter between these two countries and that Pakistan has no connection with it. [Text] [BK180729 Karachi Domestic Service in Urdu 0200 GMT 18 Jun 84]

CSO: 5100/4732

CUTBACK IN ROESSING URANIUM DETAILED

Walvis Bay NAMIB TIMES in English 25 May 84 p 9

[Text] Cutback by uranium producers announced so far this year, when fully implemented, will equal a 14 percent reduction in uranium oxide output from 1983 levels, writes Brendan Ryan the mining editor of the Johannesburg newspaper the RAND DAILY MAIL.

Uranium oxide is produced largely as a by-product of gold mining operations in South Africa. Production last year increased slightly over the 1982 level of 6,933 tons.

According to Brendan Ryan this increase was largely due to new projects started when the uranium market appeared considerably stronger than it does now.

Gencor's Beisa mine a primary uranium producer with gold as by-product is to close down as is Western Deep Levels plant. Harmony in the Rand Mines group is to close their Merriespruit treatment plant and Blyvooruitzicht is stopping its uranium operations.

Cutbacks announced before the latest round include the mothballing of the Afrikander Lease uranium plant. Anglo's Joint Metallurgical Scheme has also cut uranium production.

The reasons for the cutback, says Brendan Ryan, is the appalling state of the world uranium market. Spot prices have fallen back from 24 dollars/lb. in September last year to 17 dollars/lb. which matches the market low reached in November 1982 after the high of 44 dollars/lb in mid-1978.

Roessing Operation

Also hit by the market crunch is the world's largest mine Roessing, outside Swakopmund which is run by the Rio Tinto Zinc group, says Brendan Ryan.

He goes on to state that information on the mine's operation is hard to obtain as Roessing's management says it is not allowed to release exact production figures.

South African producers are not allowed to release details of sales volumes nor prices but may give production statistics, he adds.

The mining editor goes on to state that Roessing's annual production capacity is 5,000 short tons. He quotes a company spokesman as saying that the mine is producing at "slightly below" capacity.

The mine sells its entire output on long-term contracts to a wide-spread of consumers.

Like all uranium producers the fall in spot uranium prices has affected contract prices at Roessing but mine management will not discuss the marketing situation other than to say price negotiations are not easy.

Brendan Ryan goes on to say that Japanese uranium consumers, in particular, have taken full advantage of current market conditions to hammer down the contract uranium prices towards the spot market levels.

"Uranium producers that have come off best so far have been those which hold contracts to supply European customers who have been the least affected by the environmental backlash against nuclear power programmes," he states.

Uranium Boom Forecast

On the other hand the uranium market slump, which has seen the closure of some South African plants, will turn into a boom within four years, says an international nuclear agency.

Uranium requirement would increase and by 1988 be higher than any previous demand, says the Nuclear Energy Agency and International Atomic Energy Agency newsletter.

There was no doubt that the production to cover these needs would be achieved, it said.

The industry had to admit to the reduction in present uranium production, but said that doomsday had not yet arrived.

In South Africa the executive chairman of the Atomic Energy Commission, Dr. Wynand de Villiers said the discontinuance of uranium production by certain mines was not new here.

The industry suffered a similar decline and in 1965 some ten of the 26 uranium mines stopped production.

Nuclear power was still the only proven economic and safe alternative to oil and coal energy for the production of electricity, Dr. de Villiers said.

CSO: 5100/42

INTERNATIONAL COMPETITION FOR AKKUYU CONTRACT

Istanbul CUMHURIYET in Turkish 4 May 84 p 11

[Text] These are rather hectic days. The F-16 agreement has been signed, there are rumors flying about the agreement with the ITT. Meanwhile, the competition between Siemens KWU of West Germany and Atomic Energy of Canada Limited with regard to the Akkuyu-1 nuclear reactor project seems to be getting heated. With the approach of the month of July when it will be decided which foreign firm will be awarded the Akkuyu-1 project, a number of views are being heard in the rumor mill. Of the two firms which have received letters of intent from the Turkish government, the Atomic Energy of Canada Ltd. is said to have improved its chances since it reportedly enjoys the twin support of the U.S. government from the outside, and ENKA Holding from the inside.

Arriving amidst these developments, and after conducting talks with Prime Minister Turgut Ozal and other government officials in Ankara, Hans Hirschmann, the board chairman of Siemens KWU, spoke at a press conference in Istanbul: "The type of reactor proposed by us is more economical and less dependent at the same time."

Hirschmann explained that his firm had tendered a bid totalling DM 3.2 billion (TL 400 billion at current value) for the entire project of Akkuyu-1 nuclear electricity generating station with a planned capacity of 1000 megawatt. The financing of the import requirements of the project, estimated to be DM 2.4 billion (TL 300 billion), will be undertaken by the KWU which has arranged loans from the West German government worth DM 1.4 billion, and from European countries like Switzerland and Austria, DM 1 billion. As to the terms of the loan, no payment until the reactor is operational, 15-year payment period after that, interest paid every six months, and 8-9 percent interest.

Based on information received from Hirschmann, the remaining DM 800 million (of the DM 3.2 billion project) will be financed by Turkey in Turkish currency. If KWU is awarded the project, it will assume the sole responsibility vis-à-vis the Turkish Electricity Board. However, KWU will conduct the project in collaboration with two Turkish firms - Kutlutas and Etmas.

The KWU bid envisions the completion of Akkuyu-1 nuclear generating station in six and a half years with eighteen months preparation, and five years spent in construction. 1800 jobs would be created during that period. After the reactor becomes operational, there will be need for between 200-250 personnel.

Hirschmann, board chairman of KWU - an affiliate of Siemens, was subjected to a barrage of questions during his lengthy press conference the other day. Here are some of the points that emerged out of the question-and-answer period:

- KWU is the only firm that is capable of building both types of reactors - the ones using light water, and the ones using heavy water.

- For Turkey, KWU proposes a light water reactor using enriched uranium.

- The Canadian firm, on the other hand, proposes a heavy water reactor.

- 85 percent of the existing nuclear reactors worldwide happen to be light water reactors, only 15 percent being the heavy water type. In other words the globally preferred system is the light water reactor. All industrialized Western countries, with the exception of Canada, are using this system.

- The 'natural uranium' required by the heavy water reactor can be procured only from Canada and the Soviet Union, thus creating a 'heavy dependence' on one of these two countries during the operations of the reactor. The light water reactor, on the other hand, requires 'enriched uranium' which can be procured from any one of these countries: U.S., Britain, France, West Germany, Netherlands, Japan, and the Soviet Union.

- After Akkuyu-1, Turkey is planning to build two further nuclear electricity generating stations. Exercising one's option for the heavy water reactor in the case of Akkuyu-1 can make sense only if all future nuclear reactors in Turkey would be of the same type.

- We do not know the bid price offered by the Canadian firm. But press reports indicate that their bid is also around DM 3 billion. However, since their reactor is of 700 megawatt capacity, our offer becomes cheaper and more economical. And since light water reactors are preferred worldwide to the tune of 85 percent, it needs no discussion to decide which type is more economical.

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CSO: 5100/2565

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